KOSOVO

CLUSTER AND BUSINESS SUPPORT PROJECT

Improving Nutritional Assistance
to
Kosovo Association of Milk Producers

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Kosovo Association of Milk Producers

Improving Nutritional Assistance

Dairy Nutrition Specialist

Kosovo Cluster and Business Support Project

Trip Report: Dr. Roy Chapin, March 5 – April 29, 2005

Purpose of the Assignment

To develop the most cost effective dairy rations that are most beneficial for the Kosovo breed of cows and Kosovo dairy management systems. The best cost rations were developed to be marketed by the Kosovo Dairy Producers Association through local feed millers.

Introduction

The purpose of this narrative is to estimate **economic impact**, which is on-going, on specific dairies in Kosovo on which the Kosovo Association of Dairy Producers (KAMP) has provided nutritional assistance since the second week in March. When measuring economic impact, the most obvious and immediate as far as cash flow is concerned, is **milk flow**. In addition, there is the value of **improved milk components,** particularly **milk fat percentage and milk protein.** Improved nutrition can also improve **milk quality**.

A very real economic improvement that is happening in Kosovo is an **improvement in body condition** of cows fed improved rations. This is hard to measure but is being reported almost universally by milkers and owners. My U.S. National Research Council 2001 dairy computer program is predicting an average increase in body weight of over 500 grams a day on the rations suggested for cows giving 25 liters. This is worth over 50 cents per cow per day. This is like money in the bank as it helps sustain production throughout the lactation curve, helps improve production during the subsequent lactation and of course means the animal is worth more when she is culled for slaughter.

Another benefit of feeding improved rations is **improved animal health** as measured by such things as improved breeding performance and the catch-all category of lower vet bills. I haven't put a value on that but it is there and it is real with economic impact becoming apparent during the next twelve months and beyond after improved nutrition is implemented. In the United States I have routinely had dairymen report reduced vet bills during the twelve months following an improved dairy nutrition program, which includes improved energy, protein, vitamins, trace minerals and major minerals.

The milk price presently paid in Kosovo is very conducive to feeding for increased milk flow. Our field results show an almost immediate improvement in milk income over feed cost when the ration is improved. **The best ration is the one that makes the dairyman the most money and not the one that is the cheapest**. Most milk producers in Kosovo know this and act accordingly. Still, KAMP must be vigilant in their selling of the value

of improved nutrition and help the milk producer calculate marginal revenue and marginal costs so that he/she will make good decisions based on potential economic gain.

A survey is being conducted by KAMP representatives to evaluate the economic benefit of the improved nutrition. Specifically of improved forage harvesting and preservation, improved hygiene and milk quality technologies, improved animal genetics, improved herd management including record keeping, etc.

By working with specific dairies KAMP has demonstrated that improved feeding programs will elicit more milk along with a profound economic impact within a week of implementation of the new ration. I compliment Kosovo dairymen on their willingness to try new approaches to feeding their cows and in their rapid acceptance of new technologies when they see that it is economically beneficial to them.

Following are some specific examples from working with individual dairies in Kosovo since 9 March 2005. This economic impact evaluation will be on-going. I can report what has happened up until the latter part of April. I hope KCBS will be able to update this once a month or at least once a quarter as the improvement should become greater with time. It should be pointed out that it is difficult to increase milk production of late lactation cows. Your hope is that you can sustain their production without as much decrease in production as expected. When this late lactation cow has her dry period and enters the herd as a fresh cow, you can expect her to peak higher and sustain longer if our recommendations are followed. This means that herd average should continue to improve during the next 365 days as all cows go dry and then freshen. To ensure this result it will be necessary to monitor and advise these herds throughout the change of seasons, change in forage and feedstuff price and availability and to continue encouraging implementation of improved feeding technologies. Holding the hands of milk producers in Kosovo by KAMP staff and consultants will help increase the economic impact and increase the economic return on previous and present technology transfers.

Economic Results

The economic increase in gross profit on the selected farms that we have documented to date are:

Eurolona Dairy	2,630	Euros per month
Luma Commerce	1,300	Euros per month
Rudina	3,000	Euros per month
Dukagjini Data Dairy.	320	Euros per month
Premium Vet Dairy	1,890	Euros per month
Mazreku Dairy	6,900	Euros per month
Disa Dairy.	384	Euros per month
Agim Ramadani,	168	Euros per month
Ismail Demiri Dairy	264	Euros per month
Mujoto Dairy	660	Euros per month

Jetishi Dairy	800	Euros per month
Isufi Dairy	360	Euros per month
Qerim Qerreti Dairy	840	Euros per month
Total	19,516	Euros per month

Results from Individual Farms

A. Eurolona Dairy near the Pristina airport. Manager and owner is Milizim Berisha. On 9 March 2005, 45 cows were producing 750 liters of milk = 16.67 liters average/cow/day. Cows were not fed free choice hay as Milizim and his veterinarian (present) were told that it would unbalance the ration. Arben and I convinced him otherwise and he started feeding more hay on that day. A few days later he reported that butterfat had gone from 3.25 to 3.9% (verified by seeing his record book). This is significant economically as he is paid 25 cents/liter for milk containing 3.5% or less butterfat and 30 cents/liter if the butterfat is 3.6% or higher. This is a return of 85 cents/cow/day on an investment of about 15 cents worth of hay. **This amounts to about 1000 Euros per month on his dairy from increased butterfat alone.**

Cows are in stanchions, making it easy to feed each cow individually. We urged lining up of the cows in decreasing order of production level and feeding accordingly to help cows peak as high as possible and thus feed to raise the herd average.

His herd is made up of 31 Holsteins some Simmentals and a few Brown Swiss. The Holsteins are very thin with a body condition score of 1 to 1.5. I proposed a new ration. Since it was more expensive, he said he'd put seven Holsteins on it to test for results. After about a week he put the entire herd on the new ration near the end of March. He home mixes his own dairy mash and feeds about 10 kg of dairy mash plus 10 kg corn silage plus free choice hay (now). He will be adding wet malt. I have given him new rations. On 18 April he reported that 42 cows were producing 870 liters = 20.7 liters average. Therefore, after less than one month on new rations his cows are up four liters of milk/cow/day in addition to the increase in milk butterfat percentage. It is hard to determine exact feed costs on a dairy but using local prices for milk and feed costs and predicting milk production using the U.S. National Research Council's 2001 Dairy software, there is a strong 20 cents per liter income above feed costs per liter of extra milk. Since he is up four liters of milk, he is earning about 80 cents more per cows/day from **increased milk** production. This **will return him another 1000 Euros per month.**

In addition, it is estimated that his cows are gaining about 500 grams a day. At one euro/kg to put on weight, this **weight gain** is worth 50 cents/cow/day x 42 cows x 30 days = **630 Euros per month.**

In summary, 42 cows at Eurolona Dairy have increased the value of butterfat 1000 Euros plus 1000 from increased milk flow and an estimated 630 Euros from body weight gain = 2630 Euros more income per month since the nutritional intervention of KAMP starting about the middle of March 2005.

B. Luma Commerce. Sadri and Safet Luma are owners and managers. Working in the present economic environment that is favorable for milk production due to a strong demand for milk and favorable prices, is a welcome change. Luma Commerce used to have 140 Simmentals but is down to 70 now with the intention to replace all Simmentals with Holsteins within the year. He is milking a little over 40 cows now. Cows are group housed in six different pens inside a very nice barn so that cows can be divided by production level and fed accordingly. I think this has been done only partially. We have supplied rations to be fed to support various levels of production. Sadri indicated that he plans to implement major management changes over the next several months, including grouping according to production.

It is difficult to get absolute production levels per cow but Sadri said that present production is 23 liters, which is very good for Simmentals and this is up 2.5 to 3 liters/cow/day. This would mean that there is 50 - 60 cents gain in the value of milk/cow/day and probably about the same value from the increase of body weigh for a total of about **one Euro/cow day x 43 cows x 30 days equals about 1300 Euros per month for this dairy.**

Sadri expressed his appreciation for KAMP's help and said they were implementing new management techniques. He and I set a production goal of 25 liters/cow/day for his Simmentals and higher if he repopulates with Holsteins, which is his intention.

C. Rudina Dairy. This is one of the largest dairies in Kosovo with about 100 milking cows. Rudina processes their own milk and sells 80% as fresh milk and 20% as yogurt. They are very supportive of KAMP's involvement and reports good results from KAMP intervention including improved animal breeding performance (early indications), weight gain and improved milk flow. Mr. Orus Krasniqi, the owner, announced he plans to depopulate the Brown Swiss (65) and Simmentals (4) and replace them with Holsteins. Both he and Sadri Luma have said they like milk and money and feel Holsteins will supply more of both than other breeds. His two on-sight veterinarians don't favor the replacement of the Brown Swiss with Holsteins because of breeding problems with the Holsteins.

Holsteins are a more fragile cow and need to be fed better than Brown Swiss and Simmentals in order to reach their potential. In the meantime KAMP is working to improve milk production with the existing animals. Mr. Krasniqi spent some time in the U.S. and observed the amount of protein that is fed to high producing cows. He came home and did the same without taking care of the other nutrients, particularly minerals, and was not pleased with the results which included more health problems and eventually falling milk production. I'm not clear on the etiology of these problems. He has been relying on 200 grams of Sano's Camisan to supply enough calcium and salt. This results in serious deficiencies of both calcium and salt, particularly when milk production exceeds 15 to 20 liters. I don't know if this is causative of his problems but should be corrected by adding limestone and salt to the ration. I don't think his problems are

related to high protein intake, except that increased protein intake encourages more milk production and without balancing the rest of the ration, problems could result including morbidly thin cows, demineralization of the skeleton, reduced immune system health with susceptibility to opportunistic pathogens, poor breeding performance and eventually reduced milk production.

I have spent most of the time doing ration formulation for his beef raising project. He is to receive beef calves shortly and we're trying to maximize his inputs and outputs. This is a new service for KAMP and will need to be evaluated after it is implemented and results are known.

I have prepared rations for him to evaluate present and proposed rations using present feedstuffs plus the economic impact of feeding legume forage versus grass forage. He has received a hard copy of these data recorded in a complete Milk Money Maker computer program with six rations that will support 25, 30, 35, 40, 45 and 50 liters of milk using grass forage and another six rations using legume forage.

From what Mr. Krasniqi has reported plus reports from milkers and veterinarians, it appears that milk production is up about two liters with improved body condition amounting to about 500 grams of weight gain per day. I'm estimating that the economic impact at Rudina is about one Euro per cow/day. With 100 milking cows this would amount to **3000 Euros per month from the milking herd**.

D. Dukagjini Data Dairy. Dukagjini was using one of these rations on his herd of 20 lactating Simmental cows. Milk average/cow/day is 450 liters/20 cows = 22.5 liters. He sells retail for 40 cents per liter with some marketing costs. Cows are in good body condition. I estimated 3.5 BCS. I formulated a new ration and presented it to him with the suggestion that he feed extra protein and energy to his top producers. He has done that and 21 cows are now producing 510 liters/day = 24.28 liters/cow/day and thus his cows are up two liters in milk. Twenty four liters of milk from Simmentals is very good. The point to make here is that even at 22.5 liters of milk, the herd average can be increased by feeding the top producers better. **I'm estimating the economic impact here at 60 cents/cow/day x 21 cows x 305 days = 3,843/12 = 320 euros per month**

E. Premium Vet Dairy. This dairy near Istog is owned and run by Qerim Halilaj and Dr. Fadil Sadikaj (DVM). They are milking 38 Holsteins and a few Brown Swiss and Simmentals for a total of 44 lactating cows from which they were getting 830 liters of milk = 18.86 liters/cow/day. Milk is sold at 32 cents/liter. Cows are in tie stalls. From mid-May until November they have green grass that they will pasture or bring to the cows. Wet malt is fed throughout the year. The present ration contains corn silage, wet malt, wet beet pulp and a little hay. The dry matter content of the total ration was less than 40%. Dry matter intake was below predicted amounts. Ration dry matter should be 45% or higher. New rations were formulated including drying out the ration some by cutting back on wet feed and feeding more dry hay. Dry matter intake improved. With the new ration cows went up about three liters of milk within a week.

At our suggestion they lined up the cows by production level to ease feeding by production. A string of top producing Holsteins is averaging over 30 liters of milk/cow/day. Three weeks after KAMP intervention 42 cows were giving 1005 liters = 23.9 liters/cow/day, which is a five liter increase. This is worth at least one Euro/cow/day plus about 50 cents of weight gain/cow/day for **an estimated value of 1.5 Euros x 42 x 30 = 1890 Euros per month** of increased value since KAMP intervention. On 28 April they reported that they had five Holstein cows give 55 or more liters of milk with top cows up ten liters/head/day. They expected to increase the size of the herd by about 200 cows so the extended benefit here will be substantial. They are also looking at importing and supplying dairy premixes.

F. Teuta Mi Dairy near Peja and Istog. Manager is Shefquet Dreshaij. I visited this dairy in November of 2003 with Zijadin and Gani of KBS. By adjusting the ration then there was a marked improvement in milk production. We have no data to report from this trip as they are drying up all their cows and expecting to receive 160 Simmentals and 66 Holstein bred heifers. I have formulated a heifer ration for them. On 22 April 2005 we held a seminar there with a little over 20 participants followed by a lamb barbeque. Mr. Dreshaij said that the importation of bred heifers was delayed waiting for a letter of credit. I told him that I would like to work with him when he has a herd of milking cows.

G. Mazreku Dairy at Malashiva. This is a new dairy by the Mazreku family, Sedri – Father - and sons Osmon and Azrem. By their own admission, they are not cattle people. They invested over 500,000 Euros from their petroleum business. They have about 120 cows, 20 Brown Swiss and 100 Simmental. 110 were lactating when we first saw them on 17 March. They were marketing 1050 liters per day = 9.5 liters/cow. The calves were consuming about 100 liters so with that added in, production was about 10.5 liters/cow/day. Included in their feeding program were two kg of straw so we had them remove that immediately. They fed it because someone said they should. We gave them a new ration on 23 March, which they started within a few days. Concentrate is made by a local mill. Production started going up in about three or four days. Within three weeks it was 16.1 liters/cow/day. It has now hit over 20 liters a day. At present levels of production the value of increased milk production is about 1.80 Euros/cow/day plus an estimated 50 cents weight gain for a total of 2.3**0 x 100 cows x 30 days = 6,900 Euros per month increase in net income.**

The owners have been sorry that they invested 500,000 Euros in this dairy. They even have the foundation laid for doubling their size. KAMP can know they have made an impact if they see the expansion continue, as it was stopped due to poor production. The milk processor said that if milk production did not increase from the 10.5 liter level that the dairy would go bankrupt. I think the owners are pretty optimistic now. Osmon called Zijadin and said their biggest problem was that they needed a bigger milk tank. They are having some high acidity problems now. This is probably due to poor hygiene and could include not cooling the milk fast enough. (Confirmed to be a milk cooling tank problem.) I look for improved milk production here. I will be supplying new rations including malt. Previously there was a report written on the success of KAMP intervention at Mazreku Dairy.

H. Disa Dairy. This dairy is near Istog and owned by Bekin Osmani. There are 16 milking cows made up of one Holstein, one Simmental and the rest Montbeliarde, a French breed of cows. These 16 cows were giving 420 liters of milk = 26.0 liters/cow/day. The Holstein cow had been fresh about a month, was giving around 50 liters of milk and was melting away with a body condition score of about one. She was fed only two kg more feed. I urged that the cows be fed more forage, as the bunks were empty, and the cows be fed according to production, which they agreed to do. Three weeks later they were reporting a milk flow of 440 liters from 16 cows = 27.5/cow/day and thus an increase in herd average of 1.5 liters. This along with an anticipated improvement in body condition means that there was a improved earnings of about 80 cents/cow/day x 16 x 30 = **384 Euros per month**. The impressive development here is that even though this was the highest producing herd we encountered, there was still more milk to be produced by feeding better.

I. Agim Ramadani, Gjilan**.** 23 March 2005**.** This is a small dairy with seven milking cows (3 Holstein, 3 Simmental and 1Brown Swiss. These seven cows give 110 liters of milk = 15.7 liters/cow/day. Milk is sold at a local cheese factor for 27 cents. We met Agim earlier this week and he said production was up about two liters per cow. This will increase income on this farm about 30 cents plus about 50 cents weight gain = 80 cents x 7 x 30 = **168 Euro's/month increased net revenue.**

J. Pal Raja Dairy near Gjakova. 24 March 2005. This is a small dairy with six cows in lactation producing 98 liters = 16.3 liters/cow/day. We did the ration work and delivered it to him. To date (28 April), despite promises to implement the changes immediately, nothing has been done here. This is a disappointment to us as we used valuable assets and as yet see no benefit.

K. Ismail Demiri Dairy. 25 March 2005. This dairy has 8 cows producing 160 liters of milk = 20 liters/cow/day. We worked out a new ration for him plus encouraged him to feed hay free choice and to feed the higher producers more grain. He reported on 22 April that his cows were up three liters/cow/day in milk. Adding this to the estimated value of increased weight gain gives 1.10 x 8 x 30 = **264 Euro's increased net income per month.**

L. Rhame Xhema. Peja. 29 March 2005. Nine cows are producing 400 liters of milk = 21 liters/cow/day. Since he does not have a working lacto-fridge, he is making cheese that he sells at 2.2 Euro/kg. With a 9/1 conversion of milk to cheese this amounts to about 24.4 cents per kg of milk. This is not good. (I've been told his cheese yield is better than 9/1.) A lacto-fridge would allow him to sell his milk for about 30 cents and eliminate a whole lot of work. He has 5 Red Holsteins, 5 Brown Swiss and 9 Simmentals. He feeds alfalfa hay as the only forage. He also feeds dried malt which costs him 12 cents a pound. Wet malt costs 2 cents at the brewery. I did the ration evaluation and formulated a new ration for him that he said on 22 April that he would implement soon. There is no economic impact to report at this time.

M. Jetishi Dairy at Gjakova. 31 March 2005. Nineteen cows (11 Red Holsteins, 6 Brown Swiss and 2 Simmentals) on 31 March were producing 350 liters/day = 18.4 liters/cow/day. Cows a little thin. New rations were suggested at our visit and a complete recommendation was made the next day followed by some adjustments for use with wet malt. Argeont Jetishis reported that milk production is up 4.5 liters/cow/day on 26 April. This would mean a benefit of 90 cents plus the weight gain expected of 50 cents equals **1.4 Euros x 19 = 30 = 800 Euros/month.**

N. Berisha Dairy near KEK coal factory outside Prishtina. Twenty-two Simmental cows are producing 320 liters of milk (40 goes to calves) = 14.5 liters/cow/day. After learning what they were fed, it is fortunate that there is not higher production and the high outgo of calcium that more milk would entail. Cows are fed bran and nothing else. There is no salt, no limestone, no vitamins and mineral – nothing. The high level of wheat bran put up a red flag about high phosphorus. The ratio of absorbed calcium to phosphorus to calcium is about 1 to 2. This is bad as absorbed calcium should be above absorbed calcium to prevent demineralization of the skeleton. We gave a suggested ration while we were there and they said they would buy limestone, salt, vitamins and minerals, corn and soybean that weekend. To date, this has not happened. I have written them a letter explaining the concern I have for the calcium and sodium deficiency as well as protein inadequacy in hopes that they will make the changes necessary to prevent disaster in this herd and to increase milk production and profit. There is no economic impact to report as they haven't made any changes.

O. Mujoto Dairy at Shtime. This is a new dairy with some of the best facilities I've seen in Kosovo. Twenty lactating cows (1 Red Holstein, 11 Simmentals and 8 Brown Swiss) are producing 360 liters = 18 liters/cow/day. Cows were not fed hay or corn silage free choice. We returned with a new ration which we mixed in his barn with a shovel. Cows started up in milk on the third or fourth day. On 22 April Bajran Mujoto said the cows were up three liters in milk. He said so on two television interviews at Luma Commerce after our seminar there. Economic impact would be 60 cents net from more milk plus 50 cents from improved body weight. 1.10 x 20 x 30 = **660 Euros per month increase in net income** on this farm after about two weeks of ration implementation - and counting. The French KFOR provided them with a lacto-fridge.

P. Isufi Dairy near Ferizaj. This dairy has 14 cows in lactation with 26 heifers freshening soon. It is a little difficult to get a base line here as some cows were almost dry and the amount of milk produced didn't jive with what we saw later in his records. It appears that milk production was about 14 liters per cow/day. Cows were Montbeliarde and Brown Swiss. Both breeds are capable of producing a lot more milk than this. He was not feeding hay free choice. During our initial visit we modified his concentrate ration and urged him to feed more hay. Three days later milk production from about 11 cows had gone up over 30 liters. We gave him a new ration that he is feeding now but I don't have present production. One Isufi brother was at the Luma Commerce seminar and said to the audience how his cows had shown an immediate response from improved rations. On 15 April he reported 187 liters from 8 cows = 23.8 liters/cow/day. He dried up some low producers and his remaining cows were up in milk but it is hard to put a

number on the exact improvement. Preliminary economic impact appears to be three to five liters of milk (60 cents to one Euro) and 50 cents worth of weight gain = **1.50 x 8 x 30 = about 360 Euros/month.** The actual impact will be much higher when the 26 heifers calve and all cows are fed better.

Q. Qerim Qerreti Dairy near Peja**.** Twenty-eight cows (Mostly Simmental and Black Bulgarian plus 2 Red Holsteins and 1 Brown Swiss) are giving 600 liters = 21.4 liters/cow/day. We recommended a new ration during our visit on a Thursday the 7th of April. We return on the next Monday for a seminar and cows were up about a liter/cow/day. If we postulate on what we've seen elsewhere, there should be an improvement of at least one Euro/cow/day = 840 Euros per month.

R. Sokol Mulaj Dairy, Peja. I met Sokol in June of 2003 with Arben when we both worked with CARE International. He is one of the persons feeding according to the formulas Arben had extracted from ones I had formulated for Kosovo. He was very satisfied with production of 120 liters from 5 cows = 24 liters/cow/day. He has whole soybeans that he raised and wanted a recommendation on how to feed them, which I have supplied. There is no economic impact to report at this time. It is hoped that he can squeeze a little more milk out of his cows by increasing attention to the top producers.

S. Gjilan. Dairyman where we had a seminar in early March began feeding soybean meal last Friday. By Monday he reported a milk increase of 11 kg from 4 cows. This would amount to about **72 Euros per month.** He'll need to feed some more energy along with the protein or cows will lose weight.

We have visited a few new dairies in the last several days so impact is not know. It looks like there is an impact to date of 15,000 to 17,000 Euros's/month from about 440 cows, which would be a little over a Euro/cow/day.

In addition, we have given ten seminars to about 150 dairymen that represent 1723 cows. Some of these are included in the above count. If they follow suggestions, 1200 cows could increase net revenue a Euro/day, which would be double the above benefit and could be added to the above benefit. This will take a lot of effort to effect.

A compendium of 216 rations has been prepared. If this can be distributed throughout Kosovo, it can have an impact of about a Euro/cow/day if the suggested rations are fed. I'll be interested in feedback from Arben during the next several months.

Milk production is expected to increase with time so the economic benefit of KAMP intervention can be assessed at that time. I'm optimistic of big numbers. Follow-up is important for continued success and evaluation. The above is a rough estimate.

17 April 2005. ***Dairy Rations Suggested for Different Feeding Scenarios in Kosovo.***
Roy E. Chapin, Ph.D., Animal Nutritionist. E-mail: <roychapin@onlinemac.com>

Compendium of 216 Dairy Rations for Kosovo

April 2005

For lactating cows weighing 650 kg

fed

10 kg Wet Brewers Grains (Malt) or 2.4 kg Dried Malt or No Malt

plus

10 or 20 kg of Corn Silage or No Corn Silage

plus

Mature Grass Hay, Mature Legume Hay or Mixed Grass & Legume Hay (or equivalent dry matter amount of grass or legume silage)

or

Pasture with & without 5 kg of Mature Grass Hay & with or without Malt

and

Producing 25, 30, 35, 40, 45 or 50 liters of Milk/Cow/Day

Formulated Using

Dairy 2001 Software from U.S. National Research Council

by

Roy E. Chapin, Ph.D., Animal Nutritionist

for

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There are 36 ration series (each with six rations = 216 rations) in this presentation of possible dairy rations to feed in Kosovo. The objective is to anticipate different roughage availability with and without malt. (Malt is a concentrate; not a forage.) Roughage considerations include zero, ten or twenty kg of corn silage fed/cow/day. Within each category are rations for grass hay, legume hay or mixed grass/legume hay. **If a grass or legume silage is fed, adjust to the same dry matter intake of hay shown.** (Figure the hay at 85% dry matter and the grass/legume silage at 38 to 40%.) Also, there are rations for pasture feeding with five kg of grass hay or pasture alone. I used mature grass hay and mature legume hay as I think most hays in Kosovo fit into that category. If the hays are better than this the cow can eat more of the hay (since the amount of lignin, cellulose and hemi-cellulose – NDF - will be lower in less mature hay) and produce more milk, which will allow a greater intake of dry matter. Therefore, I'm taking some protection and cows should do better than predicted if the forage fed is better than mature forage. In formulating pasture rations I used immature grass hay. In early spring, fresh pasture will be better than this but as the season progresses, the quality will progress from excellent to not so good. I used normal corn silage. Corn silage is fairly forgiving on the stage of maturity when cut. Feeding 2.4 kg of dry malt supplies the same dry matter as feeding 10 kg of wet malt. Dry malt is 60% higher in RUP than wet malt.

Here's your index of ration choices. Choose the one that fits your feeding situation.

Series 1 to 19 are for rations without any malt.
Series 21 and higher are for rations containing 10 kg of wet malt (2.4 kg dry)/cow/day.
(subset "a" = dry for wet malt without adjustment, thus allowing milk increase. "b" = adjusted for equal milk production. "c" = using dried malt in place of soybean meal where feasible.)

Ration Series 1. No malt, no corn silage, 10 kg mature grass hay.

Ration Series 2. No malt, no corn silage, **13.7 kg mature legume hay**.

Ration Series 3. No malt, no corn silage, **11.6 kg mature grass/legume hay**.

Ration Series 4. No malt, no corn silage, **5 kg mature grass hay, pasture.**

Ration Series 5. No malt, no corn silage, **pasture.**

Ration Series 6. No malt, 10 kg corn silage, 7.3 kg mature grass hay.

Ration Series 7. No malt, 10 kg corn silage, **10 kg mature legume hay**.

Ration Series 8. No malt, 10 kg corn silage, **8.5 kg mature/legume grass hay**.

Ration Series 9. No malt, 20 kg corn silage, 4.6 kg mature grass hay.

Ration Series 10. No malt, 20 kg corn silage, **6.3 kg mature legume hay.**

Ration Series 11. No malt, 20 kg corn silage, **5.4 kg mature grass/legume hay**.

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Rations Containing 10 kg Wet Malt or 2.4 kg Dried Malt (equals same DM intake).

Ration Series 21. **10 kg wet malt, no corn silage, 10 kg mature grass hay**.

Ration Series 21a. 2.4 kg dried malt, no corn silage, 10 kg mature grass hay.
With **no ration adjustments.** Allows showing of milk increase.

Ration Series 21b. 2.4 kg dried malt, no corn silage, 10 kg mature grass hay.
With ration adjustments to a constant milk production to show the cost of feed effect if feeding dried vs. wet malt.

Rations Series 21c. Dried malt, no corn silage, 10 kg mature grass hay.
No Soybean Meal. The rations without SBM use more dried malt.

Ration Series 22. 10 kg wet malt, no corn silage, **13.7 kg mature legume hay.**

Ration Series 22a. 2.4 kg dried malt, no corn silage, 13.7 kg mature legume hay.
With **no ration adjustments. A**llows showing of milk increase.

Ration Series 22b. 2.4 kg dried malt, no corn silage, 13.7 kg mature legume hay.
With ration adjustments to a constant milk production to show the cost of feed effect if feeding dried vs. wet malt.

Rations Series 22c. Dried malt, no corn silage, 13.7 kg mature legume hay.
No Soybean Meal.

Ration Series 23. 10 kg wet malt, no corn silage, **11.6 kg mature grass/legume hay**.

Ration Series 24. 10 kg wet malt, no corn silage, **5 kg mature grass hay, pasture**.

Ration Series 24a. 2.4 kg dried malt, no corn silage, 5 kg mature grass hay, pasture.
With **no ration adjustments. A**llows showing of milk increase.

Ration Series 24b. 2.4 kg dried malt, no corn silage, 5 kg mature grass hay, pasture.
With ration adjustments to a constant milk production to show the cost of feed effect if feeding dried vs. wet malt.

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Ration Series 25. 10 kg wet malt, no corn silage, **pasture.**

Ration Series 25a. 2.4 kg dried malt, no corn silage, pasture
With **no ration adjustments.** Allows showing of milk increase.

Ration Series 25b. 2.4 kg dried malt, no corn silage, pasture
With ration adjustments to a constant milk production to show the cost of feed effect if feeding dried vs. wet malt.

Rations Series 25c. Dried malt, no corn silage**,** pasture**. No Soybean Meal.**

Ration Series 26. **10 kg wet malt malt, 10 kg corn silage, 7.3 kg mature grass hay**.

Ration Series 27. 10 kg wet malt, 10 kg corn silage, **10 kg mature legume hay**.

Ration Series 27a. 2.4 kg dried malt, 10 kg corn silage, 10 kg mature legume hay. With **no ration adjustments.** Allows showing of milk increase.

Ration Series 27b. 2.4 kg dried malt, 10 kg corn silage, 10 kg mature legume hay. **With ration adjustments** to a constant milk production to show the cost of feed effect if feeding dried vs. wet malt.

Ration Series 27c. Dried malt, 10 kg corn silage, 10 kg mature legume hay. **No Soybean Meal.**

Ration Series 28. 10 kg wet malt, 10 kg corn silage, **8.5 kg mature grass/legume hay**.

Ration Series 29. **10 kg wet malt, 20 kg corn silage, 4.6 kg mature grass hay**.

Ration Series 30. 10 kg wet malt, 20 kg corn silage, **6.4 kg mature legume hay**.

Ration Series 31. 10 kg wet malt, 20 kg corn silage, **5.3 kg mature grass/legume hay**.

The reader may ask why I'm presenting rations that will support 25, 30, 35, 40, 45 and 50 liters of milk and not lower. We should shoot for at least 25 liters milk production for all cows and I want you to see what it takes to support the higher levels of milk production. In order to raise your herd average it is necessary to feed your fresh cows to the maximum of their ability to produce milk. Challenging them with the right feed for them to peak as high as their milk potential will allow is important if you wish to maximize your herd average and profitability. Each liter more milk/cow/day at the peak of lactation results in 225 more liters/lactation. ***Feeding to the herd average will lower your herd average*** as you aren't allowing your fresh cows to peak and they are the cows that can raise your herd average. ***For additional feeding tips see my one page addendum.***

You may choose to mix one ration for the entire herd that will support say 25 or 30 liters of milk but you should top dress cows above this milk production level with more energy and protein as shown in the following rations. I suggest using a ration that is for five liters above the herd average to challenge the cows. For cows below the herd average, reduce what they are fed about two kg of the mixed ration for each five kg of milk that they are below the herd average. Challenge all cows to produce more by feeding them above their herd average. If they are thin, feed them more energy. If they are fat, feed them more rumen undegradable protein (RUP) and see if they can convert some of their excess energy intake into milk. If they don't, cut back on energy fed. Look at your cows.

Do not feed over 2.5 kg of concentrate at one feeding. Therefore, feed concentrate in multiple feedings throughout the day. Feed all the forage the cow will consume, which may be more than predicted in my formulas, particularly if it is of better quality than

assumed. Forage and concentrate should be available continually. Cows should never be without feed, except during milking time if milked in a milking parlor and this should be as short a time as possible. Feed free choice water. Make high production a game. Win!

Before proceeding further, there is some information that will help you in interpreting and applying the rations. Understanding rumen degradable and undegradable protein will help a lot. **RDP = Rumen Degradable Protein.** Intake protein (ruminants) either degrades to ammonia, amino acids and peptides in the rumen (RDP) or it gets through the rumen without degrading **(Rumen Undegradable Protein = RUP)** and supplies crude protein to the small intestine where it can be digested to amino acids and absorbed. Don't confuse RUP and "undigestible". Rumen undegradable protein must still be digested and absorbed. While shoe leather is undegradable, it is not digestible. Rumen microorganisms use RDP along with energy to proliferate into more microorganisms. These newly grown microorganisms eventually pass to the small intestine where the protein they contain is digested into amino acids (becomes RUP), absorbed and made available to the ruminant for such physiological activities as milk production. The rumen bugs can grow enough microbial protein to support 15 to 20 liters of milk. Feed high RUP sources, such as soybean meal and cottonseed meal for high milk production.

In the following tables showing the "magic" rations, the second row shows **Rumen Degradable Protein**. So What? This should be of more than passing interest to you.

If the RDP balance is negative it means that the rumen microbes are not working at full capacity because they are short of ammonia. Ammonia is the nitrogen source rumen bugs use to grow microbial protein. By adding RDP, even as urea (urea is 100% RDP as it goes to ammonia in the rumen) rumen microbes will increase their proliferation, resulting in more nutrients delivered to the small intestine. This will support increased milk production. The target milk production levels shown can be met, even with a negative RDP, if there is enough RUP in the diet to supply enough digestible amino acids at the small intestine for the blood to carry them to the udder for milk synthesis. One of the key needs for milk production is to have enough amino acids in the blood stream to meet amino acid needs at the udder. RDP is an intermediate step in that it supports rumen microbial growth that becomes RUP when the microbial bodies pass out of the rumen, reticulum, omasum and abomasum into the small intestine for digestion and absorption.

If the RDP balance is positive, it means that the rumen microbes have more RDP (ammonia, amino acids and peptides) than they can use. Adding more RDP is futile, much like trying to pour more water into a full bucket. If RDP balance is negative, adding both RDP and RUP will support more milk production. However, if the RDP balance is positive (rumen bugs can't use any more ammonia), only rumen undegradable protein (RUP) will increase the amino acids available for absorption from the small intestine and eventually to the udder for milk production. **Knowing the RDP balance situation in the rumen is fundamental to balancing dairy rations successfully.** Remember that legume forage and pasture is high in RDP (and RUP) while mature grass and corn silage is low in RDP (and RUP). (Green = RDP. Yellow = RUP.) Observe this in the following tables of rations. Knowing the RDP balance of the forage and ration will influence what protein supplements you should feed. More on this as we progress.

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It is important to balance the vitamins, trace minerals and major minerals in the total ration dry matter, particularly when feeding for higher milk production. Please read the following:

Roy Chapin's Approach to Supplying Vitamins, *Trace* Minerals & *Major* Minerals

Notice that all ration formulas show how much limestone and salt to add/cow/day. I favor supplying vitamins and ***trace*** minerals in a concentrated package (like 20 grams/cow/day) and adding the major minerals (calcium, phosphorus, salt, sulfur, etc.) after considering the contribution from forage and concentrates and the needs of high milk production. This means adjusting major minerals for each feeding situation. Two kg of wheat bran plus the soybean meal needed for higher milk production will supply adequate phosphorus. Limestone and salt must be added. If wheat bran is not fed, add a phosphorus source such as dicalcium phosphate. Determine the amount by the situation.

A Field Proven Formula for a Concentrated Mix of Vitamins and *Trace* Minerals.

The following chart shows the amount of vitamins and ***trace*** minerals that 20 grams of the Concentrated Dairy Premix will supply. ***Formula available free of charge.***

Nutrient Vit. & *Trace* Min.	**Potency/kg of Premix**	**20 grams supplies**	**Concentration Added/ kg if 25 kg DM Fed**
Vitamin A, IU	6,500,000	130,000	5200 IU/kg
Vitamin D, IU	2,000,000	40,000	1600 IU/kg
Vit. E, IU = mg	30,000	600	24 IU or mg/kg
Copper, mg	30,000	600	24 = ppm*
Cobalt, mg	500	10	0.40 = ppm
Zinc, mg	125,000	2500	100 = ppm
Selenium, mg	400	8	0.32 = ppm
Manganese, mg	40,000	800	32 = ppm
Iodine, mg	1,500	30	1.2 = ppm

*Do not feed to sheep as this level of copper may kill sheep. OK for goats.

Dry Matter Intake. Rations should be 45 % dry matter or higher for optimum dry matter intake. If feeding lots of corn silage, wet malt, wet beet pulp and/or raw potatoes, ration dry matter may be low and ration dry matter intake may be lower than anticipated. The dry matter percentage is important when silages are fed. The low dry matter content of pastures is not thought to reduce dry matter intake. However, feeding some dry hay may be of benefit, particularly in keeping butterfat percentage of the milk higher.

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Here are suggested ration formulas showing the concentrate amounts/cow/day, kg:

Series of Rations that don't contain Wet or Dry Malt

Ration Series 1. No malt, no corn silage, 10 kg mature grass hay

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-371***	***-322***	***-264***	***-218***	***-157***	***-99***
Maize (may be part other grains)	8.50	10.00	11.40	13.00	14.40	15.90
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	1.71	2.31	2.91	3.49	4.08	4.65
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (35 to 40% calcium)	0.160	0.180	0.200	0.220	0.240	0.260
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**14.51**	**16.63**	**18.65**	**20.85**	**22.87**	**24.96**
Projected Body Wt. Change/Day, Kg	***0.900***	***0.700***	***0.500***	***0.200***	***-0.100***	***-0.400***

* Or feed dairy premix of choice & adjust the limestone and salt added.
For example, if Camisan is used, add 200 grams Camisan for vitamins & trace minerals and subtract 100 grams limestone & 50 grams of salt as Camisan contains these equivalent amounts. **Adjust limestone & salt so that the dairy premix you use plus the added limestone and salt you add equals totals shown for them. Keep Ca > P!**
If wheat bran is not fed, add a phosphorus source and adjust limestone (calcium).

See page 5 for specifications for Concentrated Vitamins & Trace Minerals (20 gm/cow/day).

Ration Series 2. **No malt, no corn silage, 13.7 kg mature legume hay.** ***(Note high RDP)***

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***169***	***271***	***400***	***514***	***633***	***741***
Maize (may be part other grains)	6.80	8.10	9.20	10.40	11.60	12.90
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.09	0.93	1.84	2.70	3.57	4.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.050	0.070	0.090	0.110	0.120	0.130
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**11.08**	**13.24**	**15.27**	**17.35**	**19.44**	**21.58**
Projected Body Wt. Change/Day, Kg	***0.600***	***0.500***	***0.400***	***0.200***	***-0.100***	***-0.400***

Note projected body weight change when evaluating rations. Weight gain is like money in the bank, particularly for thin cows as cows will sustain their production longer if fed adequate energy. Plus they will milk better during the subsequent lactation and if culled, will weigh more and bring more revenue. Most of the Holsteins in Kosovo are too thin. Feeding more energy may help the rumen bugs capture more RDP.

Also note that the rumen degradable protein balance is positive where legumes are fed but when the forage is mature grass hay and/or corn silage, RDP balance is negative.

Ration Series 3. No malt, no corn silage, 11.6 kg mature grass/legume hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-187***	***-140***	***-83***	***-39***	***52***	***171***
Maize (may be part other grains)	7.90	9.40	10.8	12.40	13.70	15.00
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.86	1.46	2.07	2.64	3.36	4.20
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.120	0.130	0.150	0.160	0.180	0.190
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**13.02**	**15.13**	**17.16**	**19.34**	**21.39**	**23.54**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.600***	***0.400***	***0.200***	***-0.100***	***-0.400***

Ration Series 4. No malt, no corn silage, 5 kg mature grass hay, pasture.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-158***	***-106***	***-44***	***21***	***156***	***309***
Maize (may be part other grains)	7.70	9.20	10.60	12.10	13.30	14.40
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.62	1.22	1.83	2.46	3.35	4.30
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.130	0.150	0.170	0.190	0.210	0.220
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**12.59**	**14.71**	**16.74**	**18.89**	**21.01**	**23.07**
Projected Body Wt. Change/Day, Kg	***0.900***	***0.700***	***0.500***	***0.200***	***-0.100***	***-0.400***

Ration Series 5. No malt, no corn silage, pasture. ***(Note high RDP with pasture.)***

Ingredient, kg//Milk, liters	**25.4****	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***175***	***275***	***423***	***546***	***714***	***838***
Maize (may be part other grains)	6.50	7.80	8.90	10.20	11.10	12.40
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.78	1.73	2.60	3.60	4.46
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.120	0.140	0.150	0.160	0.180	0.200
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.76**	**12.86**	**14.92**	**17.10**	**19.03**	**21.21**
Projected Body Wt. Change/Day, Kg	***0.900***	***0.700***	***0.500***	***0.300***	***0.000***	***-0.300***

**** Note:** Where no soybean meal needs to be added in order to reach the targeted milk production, milk production may be greater than targeted. Account for this extra milk when evaluating income over feed cost. Enter costs for feed ingredients and the amount received for milk and then calculate increased income by feeding for more milk. Choose the ration series that makes the most money. Do the calculations and choose accordingly.

Ration Series 6. No malt, 10 kg corn silage, 7.3 kg mature grass hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-351***	***-308***	***-250***	***-195***	***-132***	***-80***
Maize (may be part other grains)	6.90	8.50	9.90	11.40	12.80	14.40
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	1.84	2.43	3.03	3.62	4.21	4.77
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.150	0.160	0.180	0.200	0.220	0.240
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**13.03**	**15.23**	**17.25**	**19.36**	**21.38**	**23.56**
Projected Body Wt. Change/Day, Kg	***0.900***	***0.700***	***0.500***	***0.200***	***-0.100***	***-0.400***

Ration Series 7. No malt, 10 kg corn silage, 10 kg mature legume hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-36***	***20***	***155***	***267***	***405***	***517***
Maize (may be part other grains)	6.00	7.50	8.60	9.90	11.00	12.30
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.36	1.01	1.93	2.78	3.70	4.52
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.070	0.090	0.110	0.130	0.140	0.150
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.57**	**12.74**	**14.78**	**16.95**	**18.99**	**21.12**
Projected Body Wt. Change/Day, Kg	***0.700***	***0.600***	***0.400***	***0.200***	***-0.100***	***-0.400***

Ration Series 8. No malt, 10 kg corn silage, 8.5 kg mature/legume grass hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-218***	***-179***	***-119***	***-65***	***-9***	***107***
Maize (may be part other grains)	6.50	8.10	9.50	11.00	12.50	13.80
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	1.22	1.80	2.41	3.00	3.58	4.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.120	0.140	0.150	0.160	0.180	0.200
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**11.98**	**14.18**	**16.20**	**18.30**	**20.41**	**22.55**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.600***	***0.400***	***0.200***	***-0.100***	***-0.400***

Ration Series 9. No malt, 20 kg corn silage, 4.6 kg mature grass hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-345***	***-294***	***-233***	***-178***	***-120***	***-65***
Maize (may be part other grains)	5.50	7.00	8.40	9.90	11.40	13.00
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	1.95	2.55	3.16	3.74	4.32	4.88
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.140	0.160	0.180	0.190	0.210	0.220
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**11.73**	**13.85**	**15.88**	**17.97**	**20.08**	**22.25**
Projected Body Wt. Change/Day, Kg	***0.900***	***0.700***	***0.500***	***0.200***	***-0.100***	***-0.400***

Ration Series 10. No malt, 20 kg corn silage, 6.3 kg mature legume hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-143***	***-94***	***-35***	***46***	***178***	***309***
Maize (may be part other grains)	4.90	6.40	7.80	9.20	10.40	11.60
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	1.02	1.62	2.23	2.93	3.82	4.70
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.090	0.110	0.130	0.150	0.160	0.180
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.15**	**12.27**	**14.30**	**16.42**	**18.53**	**20.63**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.600***	***0.400***	***0.200***	***-0.100***	***-0.400***

Notice how the RDP balance goes positive when legume forage or pasture is fed, particularly as more soybean meal is added to support high production. In such cases, look for protein supplements that supply high amount of rumen undegradable protein (RUP). Soybean meal is much higher (4x) in RUP than sunflower meal!

Ration Series 11. No malt, 20 kg corn silage, 5.4 kg mature grass/legume hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-247***	***-207***	***-147***	***-100***	***-35***	***55***
Maize (may be part other grains)	5.20	6.70	8.10	9.70	11.10	12.50
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	1.56	2.16	2.77	3.34	3.94	4.64
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.120	0.140	0.160	0.180	0.200	0.210
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**11.02**	**13.14**	**15.17**	**17.36**	**19.39**	**21.50**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.700***	***0.400***	***0.200***	***-0.100***	***-0.400***

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Series of Rations Containing <u>Wet or Dry Malt</u> on equal dry matter or without SBM.

Ration Series 21. **<u>10 kg wet malt</u>, no corn silage, 10.3 kg mature grass hay.**

<u>Ingredient, kg//Milk, liters</u>	**<u>25</u>**	**<u>30</u>**	**<u>35</u>**	**<u>40</u>**	**<u>45</u>**	**<u>50</u>**
Rumen Degradable Protein Balance	***-355***	***-295***	***-237***	***-185***	***-123***	***-73***
Maize (may be part other grains)	7.10	8.70	10.10	11.60	13.00	14.60
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.61	1.20	1.81	2.40	3.00	3.56
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.150	0.160	0.180	0.200	0.220	0.240
<u>Salt</u>	<u>0.120</u>	<u>0.120</u>	<u>0.120</u>	<u>0.120</u>	<u>0.125</u>	<u>0.130</u>
Concentrate/Cow/Day, kg	**12.00**	**14.20**	**16.23**	**18.34**	**20.37**	**22.55**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.700***	***0.400***	***0.200***	***-0.100***	***-0.400***

Ration Series 21a. <u>2.4 kg dried malt,</u> no corn silage, 10.3 kg mature grass hay.
With **<u>no ration adjustments</u>** that allows showing of milk increase.

<u>Ingredient, kg//Milk, liters</u>	**<u>25.6</u>**	**<u>30.6</u>**	**<u>35.6</u>**	**<u>40.6</u>**	**<u>45.6</u>**	**<u>50.6</u>**
Rumen Degradable Protein Balance	***-452***	***-413***	***-358***	***-307***	***-247***	***-199***
Maize (may be part other grains)	7.10	8.70	10.10	11.60	13.00	14.60
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.61	1.20	1.81	2.40	3.00	3.56
Dried Brewers Grains, malt	2.40	2.40	2.40	2.40	2.40	2.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.150	0.160	0.180	0.200	0.220	0.240
<u>Salt</u>	<u>0.120</u>	<u>0.120</u>	<u>0.120</u>	<u>0.120</u>	<u>0.125</u>	<u>0.130</u>
Concentrate/Cow/Day, kg	**14.40**	**16.60**	**18.63**	**20.74**	**22.77**	**24.95**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.700***	***0.400***	***0.200***	***-0.100***	***-0.400***

When RDP is in negative balance note the small increase of only 0.6 liters of milk when 2.4 kg dried malt replaces 10 kg wet malt. Drying malt decreases the amount of the protein that is RDP and increases the amount that is RUP. (% RDP + % RUP = % Crude Protein). With corn silage and/or mature grass forage, milk production increase from switching from wet to dried malt is small because animal needs both RDP & RUP. Compare with ration series when RDP balance is positive (legumes and pasture). With a positive RDP balance, there is no value from feeding more RDP. Since drying of malt decreases RDP and increases RUP about 60%, there is a huge milk increase (over two liters) when dry malt replaces wet malt (on the same dry matter basis) when RDP balance is positive, such as with legume forages and/or pastures. If the cow has the genetic potential to produce more milk and she needs more RUP, feeding heat treated (dried) malt in place of wet malt will allow her to increase milk production about 2.3 kg. Test her ability to give more milk by feeding a little more protein and noting milk response.

Potatoes. You can substitute raw or processed potatoes for corn on an equal dry matter (DM) basis - say 2 kg of DM. Keep total ration DM (TRDM) above 45%. If processed potatoes with vegetable oil added is fed, be sure to keep ration fat below 5% of TRDM.

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Ration Series 21b. 2.4 kg dried malt, no corn silage, 10.3 kg mature grass hay.
With ration adjustments to a constant milk production to show the economic impact of feeding dried vs. wet malt.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-476***	***-440***	***-383***	***-333***	***-272***	***-224***
Maize (may be part other grains)	7.20	8.80	10.20	11.70	13.10	14.70
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.52	1.10	1.71	2.30	2.90	3.46
Dried Brewers Grains	2.40	2.40	2.40	2.40	2.40	2.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.150	0.160	0.180	0.200	0.220	0.240
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**14.41**	**16.60**	**18.63**	**20.74**	**22.77**	**24.95**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.600***	***0.400***	***0.200***	***-0.100***	***-0.400***

Note negative RDP balance when corn silage and mature grass hay is fed.

Ration Series 21c. kg Dried malt, no corn silage, 10.3 kg mature grass hay.
No Soybean Meal.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-540***	***-525***	***-542***	***-555***	***-563***	***-573***
Maize (may be part other grains)	6.67	7.60	8.30	9.20	10.00	10.9
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.00	0.00	0.00	0.00	0.00
Dried Brewers Grains, malt	3.43	4.63	5.88	7.07	8.27	9.45
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.150	0.160	0.180	0.200	0.220	0.240
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**14.39**	**16.53**	**18.50**	**20.61**	**22.64**	**24.74**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.600***	***0.400***	***0.200***	***-0.100***	***-0.400***

Energy Needs. Cows require energy of course. Rumen microorganisms need non-fiber carbohydrates (NFC) (mainly starch and sugar) which they transform to volatile fatty acids (VFA's) which are used by the microbes along with RDP – ammonia, amino acids and peptides – to proliferate and grow so the microbes can become RUP when they pass to the small intestine and are absorbed into the blood stream for use throughout the body, including the synthesis of milk. The udder needs amino acids and energy to produce milk. If the cow is thin, add energy. If it is fat, add protein – RUP. Feed by your eyes!

Cows need water available free choice throughout the day - 24/7. Milk is mainly water and a cow deprived of water will go down in milk that day. Without water a cow reduces its intake of dry matter. A cow has its greatest propensity to eat and drink right after milking, so have feed and water available then and throughout the day.

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Ration Series 22. 10 kg wet malt, no corn silage, 13.7 kg mature legume hay.

Ingredient, kg//Milk, liters	**26.6**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***476***	***387***	***500***	***602***	***712***	***817***
Maize (may be part other grains)	4.40	6.40	7.60	8.90	10.10	11.40
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.12	0.99	1.82	2.66	3.48
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.050	0.070	0.080	0.090	0.100	0.110
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**8.59**	**10.73**	**12.81**	**14.95**	**17.01**	**19.14**
Projected Body Wt. Change/Day, Kg	***0.600***	***0.500***	***0.300***	***0.100***	***-0.100***	***-0.400***

Note positive RDP balance when a legume is fed, even when it is a mature legume.

Ration Series 22a. 2.4 kg dried malt, no corn silage, 13.7 kg mature legume hay.
With **no ration adjustments** that allows showing of milk increase.

Ingredient, kg//Milk, liters	**28.8**	**32.2**	**37.2**	**42.3**	**47.3**	**52.3**
Rumen Degradable Protein Balance	***358***	***267***	***379***	***479***	***588***	***691***
Maize (may be part other grains)	4.40	6.40	7.60	8.90	10.10	11.40
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.12	0.99	1.82	2.66	3.48
Dried Brewers Grains, malt	2.40	2.40	2.40	2.40	2.40	2.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.050	0.070	0.080	0.090	0.100	0.110
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.99**	**13.13**	**15.21**	**17.35**	**19.41**	**21.54**
Projected Body Wt. Change/Day, Kg	***0.600***	***0.500***	***0.300***	***0.100***	***-0.100***	***-0.400***

Ration Series 22b. 2.4 kg dried malt, no corn silage, 13.7 kg mature legume hay.
With ration adjustments to a constant milk production to show the cost of feed effect if feeding dried vs. wet malt.

Ingredient, kg//Milk, liters	**28.8**	**31.9**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***358***	***237***	***126***	***232***	***365***	***472***
Maize (may be part other grains)	4.40	6.50	8.60	9.90	11.00	12.30
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.00	0.00	0.84	1.76	2.58
Dried Brewers Grains, malt	2.40	2.40	2.40	2.40	2.40	2.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.050	0.070	0.080	0.090	0.100	0.110
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.99**	**13.11**	**15.22**	**17.37**	**19.41**	**21.54**
Projected Body Wt. Change/Day, Kg	***0.600***	***0.400***	***0.300***	***0.100***	***-0.100***	***-0.400***

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Rations Series 22c. Dried malt, no corn silage, 13.7 kg mature legume hay. No Soybean Meal.

Ingredient, kg//Milk, liters	**28.8**	**31.9**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***358***	***237***	***126***	***115***	***103***	***88***
Maize (may be part other grains)	4.40	6.50	8.60	9.50	10.40	11.40
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal**	0.00	0.00	0.00	0.00	0.00	0.00
Dried Brewers Grains, malt	2.40	2.40	2.40	3.57	4.72	5.83
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.050	0.070	0.080	0.090	0.100	0.110
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.99**	**13.11**	**15.22**	**17.30**	**19.37**	**21.49**
Projected Body Wt. Change/Day, Kg	***0.600***	***0.400***	***0.300***	***0.100***	***-0.200***	***-0.500***

Note how dried malt can replace soybean meal when RDP balance is positive.

Ration Series 23. 10 kg wet malt, no corn silage, 11.6 kg mature grass/legume hay.

Ingredient, kg//Milk, liters	**26.4**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-86***	***-107***	***-51***	***-1***	***125***	***242***
Maize (may be part other grains)	6.30	8.10	9.50	11.00	12.20	13.50
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.36	0.97	1.56	2.44	3.28
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.100	0.120	0.140	0.160	0.180	0.190
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.54**	**12.72**	**14.75**	**16.86**	**18.97**	**21.12**
Projected Body Wt. Change/Day, Kg	***0.700***	***0.600***	***0.400***	***0.100***	***-0.100***	***-0.400***

Note how RDP goes from negative to positive as SBM added for higher production.

Ration Series 24. 10 kg wet malt, no corn silage, 5 kg mature grass hay, pasture.

Ingredient, kg//Milk, liters	**27.8**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***0***	***-77***	***-17***	***94***	***241***	***362***
Maize (may be part other grains)	5.90	7.90	9.30	10.60	11.70	13.00
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.12	0.73	1.54	2.48	3.32
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.130	0.150	0.170	0.180	0.200	0.210
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.17**	**12.31**	**14.34**	**16.46**	**18.53**	**20.68**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.700***	***0.500***	***0.200***	***0.000***	***-0.400***

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Ration Series 24a. 2.4 kg dried malt, no corn silage, 5 kg mature grass hay, pasture. With **no ration adjustments** that allows showing of milk increase.

Ingredient, kg//Milk, liters	**28.4**	**30.6**	**35.6**	**41.9**	**47.3**	**52.3**
Rumen Degradable Protein Balance	***-117***	***-196***	***-138***	***-29***	***116***	***235***
Maize (may be part other grains)	5.90	7.90	9.30	10.60	11.70	13.00
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.12	0.73	1.54	2.48	3.32
Dried Brewers Grains, malt	2.40	2.40	2.40	2.40	2.40	2.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.130	0.150	0.170	0.180	0.200	0.210
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**12.57**	**14.71**	**16.74**	**18.86**	**20.93**	**23.08**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.700***	***0.500***	***0.200***	***0.000***	***-0.400***

Note increase of 0.6 liters milk when 2.4 kg dried malt replaces 10 kg wet malt when RDP balance negative but when RDP balance goes positive, note large increase in milk production.

Ration Series 24b. 2.4 kg dried malt, no corn silage, 5 kg mature grass hay, pasture. **With ration adjustments** to a constant milk production to show the economic impact of feeding dried vs. wet malt.

Ingredient, kg//Milk, liters	**28.4**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-117***	***-223***	***-163***	***-116***	***-46***	***27***
Maize (may be part other grains)	5.90	8.00	9.40	11.00	12.30	13.80
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.02	0.63	1.21	1.82	2.46
Dried Brewers Grains, malt	2.40	2.40	2.40	2.40	2.40	2.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.130	0.150	0.170	0.180	0.200	0.210
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**12.57**	**14.71**	**16.74**	**18.93**	**20.87**	**23.02**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.700***	***0.400***	***0.200***	***-0.100***	***-0.400***

Protein supplements are not created equal in the percentages of their protein that goes to RDP and RUP. Sunflower meal (SFM) is not a good source of protein for high producing cows that need lots of RUP as the protein in solvent processed SFM goes about 85% to RDP and only 15% to RUP. Therefore, SFM will help support milk production up to 15 to 20 liters of milk of cows fed corn silage and/or mature grass hay. When legumes and pasture are fed, SFM is almost useless as the rumen already has more RDP than it can use. In such cases and for high production it is necessary to feed a protein supplement where more of the crude protein goes to RUP. Soybean meal (SBM) supplies about four times as much RUP as SFM. Per 100 grams of dry matter SFM supplies 4.1 grams of digestible RUP; 44% solvent SBM supplies 16 grams, 44% mechanically extracted SBM, 30 grams; solvent cottonseed meal, 20 grams. Corn supplies 4 grams dig. RUP/100 grams of dry matter – almost as much as SFM and with a lot more energy.

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Ration Series 25. 10 kg wet malt, no corn silage, pasture.

Ingredient, kg//Milk, liters	**27.2**	**30.2**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***502***	***393***	***514***	***634***	***786***	***905***
Maize (may be part other grains)	4.00	6.10	7.30	8.60	9.60	10.90
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.00	0.86	1.73	2.68	3.52
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.100	0.120	0.140	0.160	0.170	0.180
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**8.24**	**10.36**	**12.44**	**14.63**	**16.60**	**18.75**
Projected Body Wt. Change/Day, Kg	***0.900***	***0.700***	***0.500***	***0.300***	***0.000***	***-0.300***

Ration Series 25a. 2.4 kg dried malt, no corn silage, pasture.
With **no ration adjustments** and therefore showing milk increase.

Ingredient, kg//Milk, liters	**29.4**	**32.4**	**37.4**	**42.3**	**47.3**	**52.3**
Rumen Degradable Protein Balance	***385***	***275***	***393***	***511***	***661***	***778***
Maize (may be part other grains)	4.00	6.10	7.30	8.60	9.60	10.90
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.00	0.86	1.73	2.68	3.52
Dried Brewers Grains, malt	2.40	2.40	2.40	2.40	2.40	2.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.100	0.120	0.140	0.160	0.170	0.180
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.64**	**12.76**	**14.84**	**17.03**	**19.00**	**21.15**
Projected Body Wt. Change/Day, Kg	***0.900***	***0.700***	***0.500***	***0.300***	***0.000***	***-0.300***

Note that there is 2.3 liters/cow/day increase in milk production from replacing 10 kg wet malt with 2.4 kg dry malt when rumen degradable protein balance (RDP) is positive. There is no benefit from feeding more RDP than the rumen can use. There is a huge benefit from feeding more RUP. In this situation, replacing soybean meal with dried malt generally is cost effective as dried malt has almost as much digestible RUP as 44% solvent extracted soybean meal (80 to 85% as much). You can test this easily on your cows. Pick out a few high producing cows to which you are feeding malt and legume hay or pasture and replace ten kg of wet malt with 2.4 kg of dry malt (equal dry matter) and see if there is a milk increase. Note the "c" subset of formulas where dried malt is used exclusively for RUP in place of soybean meal. Calculate your feed costs. I think dried malt will be more economical to feed than wet malt if the cow has a positive RDP balance from eating legume, immature grass hay and/or pasture. Test your cows to see if they have the potential to give more milk by feeding increasing amounts of dry malt to them and note the income from milk versus the cost of the feed. The cow will respond within a week to give you her answer. You can try this feeding test with soybean meal and corn also. Make it a game to help each cow peak and sustain her lactation so she gives the maximum amount of milk. Each kg of milk at the peak of lactation predicts 225 more kg of milk for the entire lactation. Help her to peak high by feeding more rumen undegradable protein. Help her sustain her lactation by feeding adequate energy. Adjust by body condition.

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Ration Series 25b. 2.4 kg dried malt, no corn silage, pasture.
With ration adjustments to a constant milk production to show the economic impact of feeding dried vs. wet malt.

Ingredient, kg//Milk, liters	**29.4**	**32.4**	**35.3**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***385***	***275***	***171***	***278***	***436***	***548***
Maize (may be part other grains)	4.00	6.10	8.20	9.50	10.50	11.90
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.00	0.00	0.80	1.77	2.59
Dried Brewers Grains, malt	2.40	2.40	2.40	2.40	2.40	2.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.100	0.120	0.140	0.160	0.170	0.180
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.64**	**12.76**	**14.88**	**17.00**	**18.99**	**21.22**
Projected Body Wt. Change/Day, Kg	***0.900***	***0.700***	***0.500***	***0.300***	***0.000***	***-0.300***

Rations Series 25c. Dried malt, no corn silage, pasture
No Soybean Meal.

Ingredient, kg//Milk, liters	**29.4**	**32.4**	**35.3**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***385***	***275***	***171***	***158***	***160***	***154***
Maize (may be part other grains)	4.00	6.10	8.20	9.20	10.00	11.00
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.00	0.00	0.00	0.00	0.00
Dried Brewers Grains, malt	2.40	2.40	2.40	3.45	4.66	5.80
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.100	0.120	0.140	0.160	0.170	0.180
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.64**	**12.76**	**14.88**	**16.95**	**18.98**	**21.13**
Projected Body Wt. Change/Day, Kg	***0.900***	***0.700***	***0.500***	***0.200***	***0.000***	***-0.300***

Ration Series 26. 10 kg wet malt, 10 kg corn silage, 7.3 kg mature grass hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-320***	***-272***	***-214***	***-169***	***-106***	***-47***
Maize (may be part other grains)	5.60	7.10	8.50	10.10	11.50	13.00
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.74	1.34	1.95	2.52	3.12	3.70
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.140	0.160	0.180	0.200	0.220	0.240
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.62**	**12.74**	**14.77**	**16.96**	**18.99**	**21.09**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.700***	***0.400***	***0.200***	***-0.100***	***-0.400***

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Note negative RDP balance when the forage is corn silage and mature grass hay.

Ration Series 27. **10 kg wet malt, 10 kg corn silage, 10 kg mature legume hay.**

Ingredient, kg//Milk, liters	**26.5**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***197***	***120***	***255***	***373***	***494***	***605***
Maize (may be part other grains)	3.90	5.90	7.00	8.20	9.40	10.70
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.15	1.08	1.95	2.82	3.65
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.600	0.080	0.100	0.120	0.130	0.140
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**8.10**	**10.27**	**12.32**	**14.41**	**16.50**	**18.64**
Projected Body Wt. Change/Day, Kg	***0.600***	***0.500***	***0.300***	***0.100***	***-0.100***	***-0.400***

Note positive RDP balance when the forage is legume hay.

Ration Series 27a. **2.4 kg dried malt, 10 kg corn silage, 10 kg mature legume hay.**
With **no ration adjustments** that allows showing of milk increase.

Ingredient, kg//Milk, liters	**28.7**	**32.2**	**37.3**	**42.3**	**47.3**	**52.3**
Rumen Degradable Protein Balance	***79***	***0***	***133***	***250***	***370***	***481***
Maize (may be part other grains)	3.90	5.90	7.00	8.20	9.40	10.70
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.15	1.08	1.95	2.82	3.65
Dried Brewers Grains, malt	2.40	2.40	2.40	2.40	2.402	2.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.600	0.080	0.100	0.120	0.130	0.140
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.50**	**12.67**	**14.72**	**16.81**	**18.90**	**21.04**
Projected Body Wt. Change/Day, Kg	***0.600***	***0.500***	***0.300***	***0.100***	***-0.100***	***-0.400***

For rumen microorganisms to proliferate, they need RDP, VFA'S (volatile fatty acids) and minerals. Of particular interest is sulfur as sulfur is required for the rumen microorganisms to synthesize the sulfur containing amino acids, methionine, cystine and cysteine. Without adequate sulfur rumen microbes can't grow and thus the ruminant is deprived of this important feed source. The nitrogen/sulfur ratio should be 10/1 to 12/1.

The major minerals required by ruminants are: calcium, phosphorus, magnesium, potassium, sodium, chloride & sulfur. Keep calcium higher than phosphorus (absorbed).

The trace minerals required by ruminants are: cobalt, copper, iodine, iron, manganese, selenium and zinc. There is enough iron in feedstuffs so don't added iron.

Ruminants require vitamins A, D & E in the diet. The need is related more to body size than milk production. Vitamins & ***trace*** minerals can be supplied in 20 gm/cow/day.

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Ration Series 27b. 2.4 kg dried malt, 10 kg corn silage, 10 kg mature legume hay.
With ration adjustments to a constant milk production to show the cost of feed effect if feeding dried vs. wet malt.

Ingredient, kg//Milk, liters	**28.7**	**31.4**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***79***	***-42***	***-45***	***7***	***143***	***248***
Maize (may be part other grains)	3.90	6.10	7.70	9.20	10.30	11.70
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.000	0.38	0.99	1.90	2.71
Dried Brewers Grains, malt	2.40	2.40	2.40	2.40	2.402	2.40
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.600	0.080	0.100	0.120	0.130	0.140
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.50**	**12.72**	**14.72**	**16.85**	**18.88**	**21.10**
Projected Body Wt. Change/Day, Kg	***0.600***	***0.500***	***0.300***	***0.100***	***-0.200***	***-0.400***

Ration Series 27c. Dried malt, 10 kg corn silage, 10 kg mature legume hay.
No Soybean Meal.

Ingredient, kg//Milk, liters	**28.7**	**31.4**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***79***	***-42***	***-81***	***-91***	***-95***	***-102***
Maize (may be part other grains)	3.90	6.10	7.30	8.20	9.00	9.90
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.000	0.00	0.00	0.00	0.00
Dried Brewers Grains, malt	2.40	2.40	3.17	4.37	5.58	6.76
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.600	0.080	0.100	0.120	0.130	0.140
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**10.50**	**12.72**	**14.71**	**16.83**	**18.86**	**20.95**
Projected Body Wt. Change/Day, Kg	***0.600***	***0.500***	***0.300***	***0.100***	***-0.200***	***-0.500***

Ration Series 28. 10 kg malt, 10 kg corn silage, 8.5 kg mature grass/legume hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-187***	***-137***	***-82***	***-37***	***54***	***201***
Maize (may be part other grains)	5.20	6.70	8.10	9.70	11.00	12.10
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.10	0.72	1.32	1.90	2.62	3.56
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.110	0.120	0.140	0.160	0.180	0.200
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**9.55**	**11.68**	**13.70**	**15.90**	**17.95**	**20.01**
Projected Body Wt. Change/Day, Kg	***0.700***	***0.600***	***0.400***	***0.200***	***-0.100***	***-0.400***

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Ration Series 29. 10 kg wet malt, 20 kg corn silage, 4.6 kg mature grass hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-306***	***-258***	***-198***	***-144***	***-89***	***-28***
Maize (may be part other grains)	4.10	5.60	7.00	8.50	10.00	11.50
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.86	1.46	2.07	2.66	3.24	3.82
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.140	0.160	0.180	0.200	0.220	0.240
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**9.24**	**11.36**	**13.39**	**15.50**	**17.61**	**16.71**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.700***	***0.400***	***0.200***	***-0.100***	***-0.400***

Ration Series 30. 10 kg wet malt, 20 kg corn silage, 6.4 kg mature legume hay.

Ingredient, kg//Milk, liters	**25.4**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-79***	***-53***	***6***	***121***	***261***	***393***
Maize (may be part other grains)	3.40	5.00	6.40	7.70	8.80	10.00
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.00	0.53	1.15	2.00	2.92	3.81
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.800	0.100	0.120	0.140	0.150	0.160
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**7.62**	**9.77**	**11.81**	**13.98**	**16.02**	**18.12**
Projected Body Wt. Change/Day, Kg	***0.700***	***0.600***	***0.400***	***0.200***	***-0.100***	***-0.400***

Ration Series 31. 10 kg wet malt, 20 kg corn silage, 5.3 kg mature grass/legume hay.

Ingredient, kg//Milk, liters	**25**	**30**	**35**	**40**	**45**	**50**
Rumen Degradable Protein Balance	***-219***	***-176***	***-117***	***-63***	***0***	***121***
Maize (may be part other grains)	3.80	5.40	6.80	8.30	9.70	11.00
Beet Pulp (or grain of choice)	2.00	2.00	2.00	2.00	2.00	2.00
*Wheat Bran (phosphorus source)	2.00	2.00	2.00	2.00	2.00	2.00
Soybean Meal **(not sunflower meal)**	0.46	1.06	1.67	2.26	2.86	3.70
*Vitamins & ***Trace*** Minerals	0.020	0.020	0.020	0.020	0.020	0.020
Limestone (calcium)	0.110	0.130	0.140	0.160	0.180	0.190
Salt	0.120	0.120	0.120	0.120	0.125	0.130
Concentrate/Cow/Day, kg	**8.51**	**10.73**	**12.75**	**14.86**	**16.89**	**19.04**
Projected Body Wt. Change/Day, Kg	***0.800***	***0.600***	***0.400***	***0.200***	***-0.100***	***-0.400***

Formulas created by Roy E. Chapin, Ph.D., Animal Nutritionist, using the U.S. National Research Council's 2001 Dairy Nutrient Requirements and accompanying software. Formulations are for 650 kg Holstein cows in first lactation, 32 months of age, 160 days fresh (60 days pregnant) producing milk quantities as shown containing 4.0% butterfat.